
Space Weather Technical Forecast

Issued on Wednesday, 17 January 2024 at 01:01 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Chance of isolated M-class flares.**Analysis of Space Weather Activity over past 24 hours**

Solar Activity: Solar activity is at Low levels, with only C-Class activity recorded. There are currently thirteen sunspots on the visible disc, five of which are unnumbered. AR3541 in the southwest is becoming increasingly difficult to assess as it approaches the limb, it remains an elongated yet sparsely populated spot. AR3549 remains dominated by a large leader spot followed by small trailing regions. AR3545 in the southwest has shown slight growth recently, now with tenuous signs of a delta region perhaps beginning to form in the large penumbral area. All other regions appear small and/or simple.

No CMEs observable on coronagraph imagery over the past 24 hours are expected to have an Earth-directed component.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by DSCOVR and ACE, have been near background levels, averaging 300-400 km/s. Density has been around average or below. The interplanetary magnetic field (IMF), Bt, has been generally weak throughout. The north-south component, Bz, was weak, fluctuating between +7/-4nT. Phi angle fluctuated almost equally between negative (toward the Sun) and positive (away from the Sun). Geomagnetic activity was mostly Quiet (Kp 0-2), with a brief interlude of Unsettled (Kp3) 16/0000-0300.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels.

GOES16 high energy (greater than 2MeV) electron flux was at background to moderate levels. The associated 24-hour fluence was well below Active (1e8 integrated pfu) throughout. The 17/0000 UTC 24-hour integrated fluence observation was 1.08e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of isolated M-class activity throughout.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

The high speed stream of CH92/+, with potential speeds of 400-500 km/s, is expected to influence the near Earth environment day 1 (17 Jan), with the effects waning day 2 (18 Jan) before the high speed stream of CH93/+ possibly arrives day 4 (20 Jan), with speeds around 450-500 km/s once again.

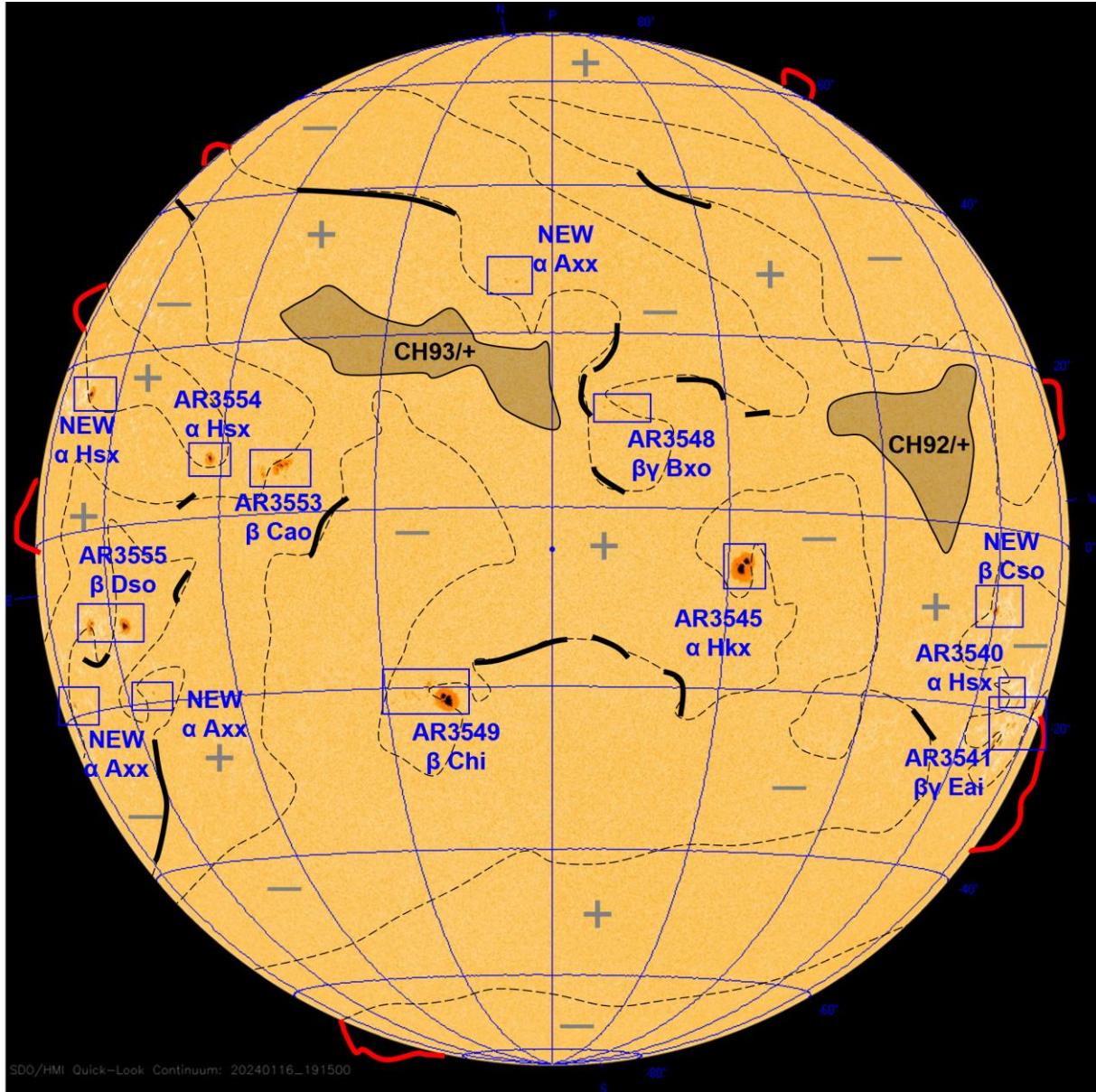
Overall, geomagnetic activity is likely to be largely Quiet (Kp 0-2). There is a chance of Unsettled to Active (Kp 3-4) intervals mainly on day 1 (17 Jan), and again on day 4 (20 Jan) upon the connection to the anticipated coronal hole high speed streams.

Energetic Particles / Solar Radiation: High energy proton flux will most likely remain at background levels. Although, there remains an ongoing slight chance of seeing an increase to the S1/Minor Radiation Storm threshold should any notable flares occur.

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The high energy electron flux is forecast to persist at generally background to moderate levels, with fluence expected to remain below the Active threshold through the period.

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

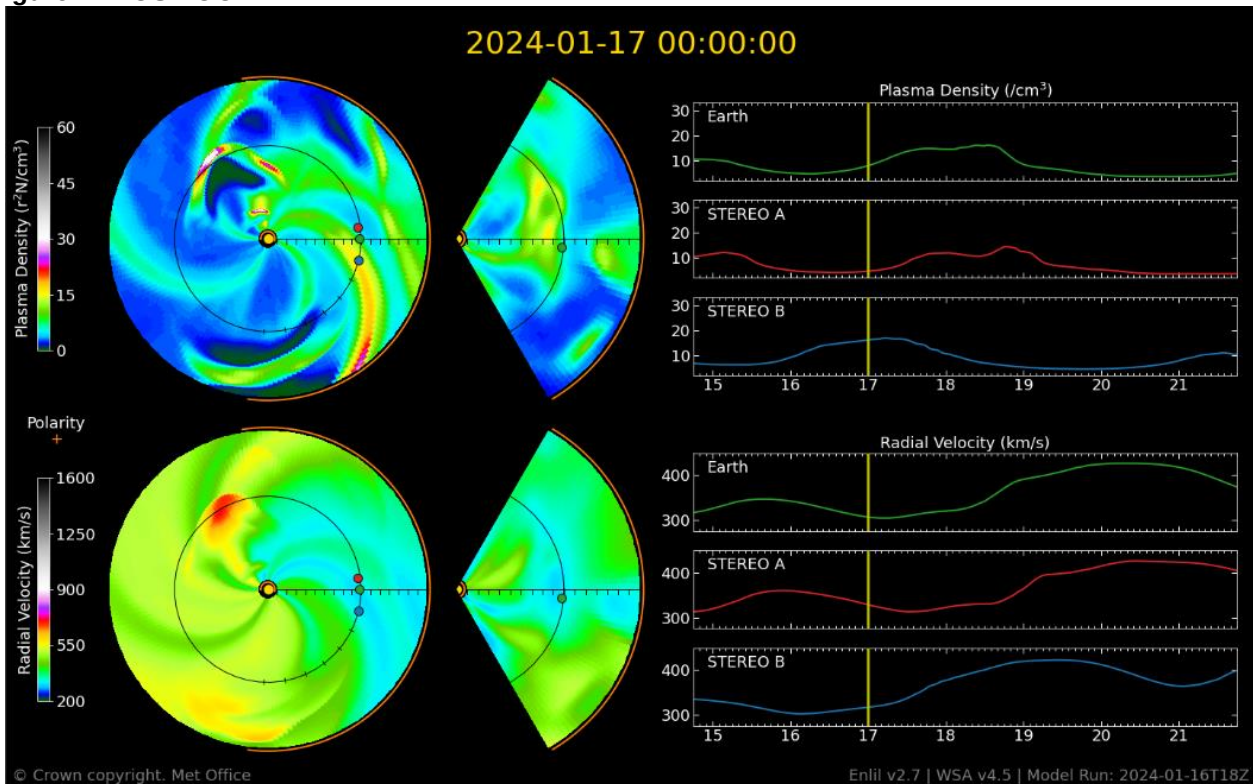
No Earth-directed CMEs currently feature in the forecast.

Solar wind speeds are expected to remain at slow-ambient levels initially before the high speed stream of CH92/+ arrives. This coronal hole is a persistent feature, but is smaller and with a leading edge further east than last rotation. Solar wind speeds may reach 400-500 km/s, arriving 17 Jan. This feature is then expected to wane 18 or 19 Jan, before the next coronal hole high speed stream (CH93/+) arrives possibly on 20 Jan, perhaps with wind speeds reaching 450-500 km/s once again.

Overall, geomagnetic activity is likely to be largely Quiet (Kp 0-2). There is a chance of Unsettled to Active (Kp 3-4) intervals mainly on day 1 (17 Jan) and again on day 4 (20 Jan) upon the connection to the anticipated coronal hole high speed streams.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	1	1	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC ENLIL



Radio Blackouts - X-Ray Flares:

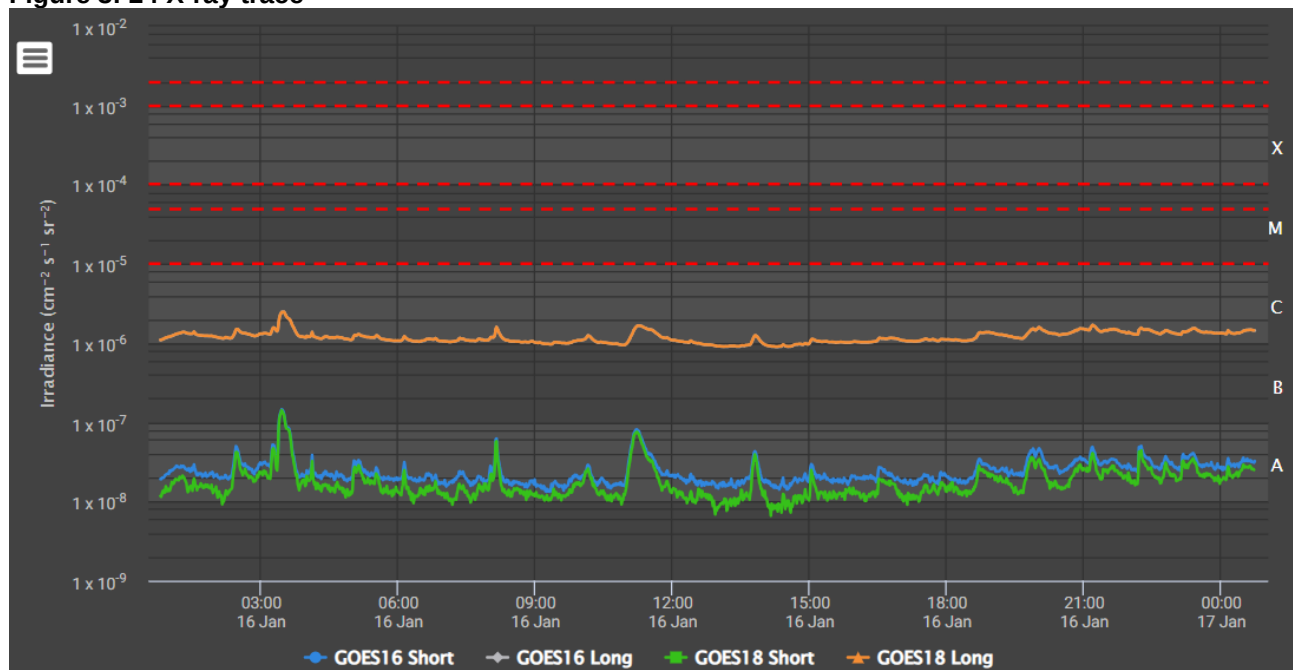
Solar activity remains at Low levels with only minor C-class activity. There are currently thirteen sunspots on the visible disc, five of which are unnumbered. There is now no evidence of what was AR3552. AR3541 in the southwest is becoming increasingly difficult to assess as it approaches the limb, it remains an elongated yet sparsely populated spot. AR3549 remains dominated by a large leader spot followed by small trailing regions. AR3545 in the southwest has shown slight growth recently, now with tenuous signs of a delta region perhaps beginning to form in the large penumbral area. All other regions appear small and/or simple.

Seismic far-side analysis and recurrence would suggest that one or more regions may return or rotate across the eastern limb through the period, this perhaps going some way to maintaining flare risk following the loss of the AR3541 complex.

Solar activity is expected to remain at Low levels with a chance of isolated M-class flares given the number of spots on the disk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: 24 X-ray trace



Solar Radiation Storms - (High Energy Protons):

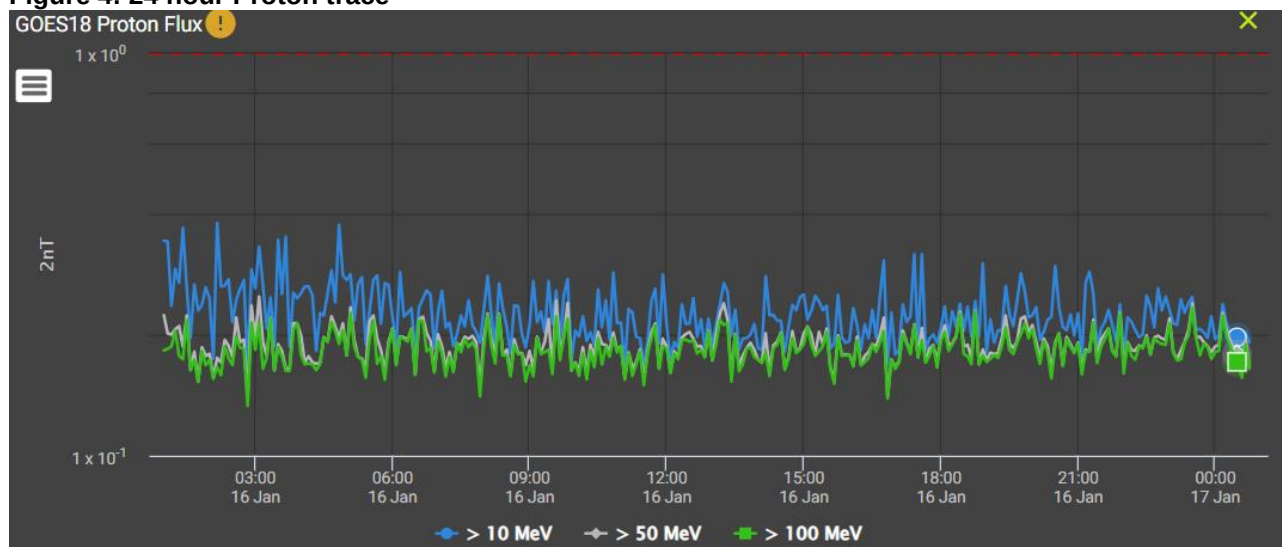
GOES18 high energy (greater than 10MeV) proton flux is currently at background levels. Any further notable flares will bring a risk of proton flux rising, especially if they occur close to the western limb. Overall, there is a continuing slight chance of reaching the S1/Minor Radiation Storm threshold. With the probability maintained as a number of regions depart, whilst others rotate onto or across the visible disc.

Please note: GOES18 is currently being used as the primary proton instrument, with GOES16 data currently viewed as unreliable due to a fault reported by NOAA.

Radiation Storms	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	5	5	5	5
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* S3 $\geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

Figure 4: 24 hour Proton trace



High Energy Electrons Event ($\geq 2\text{MeV}$):

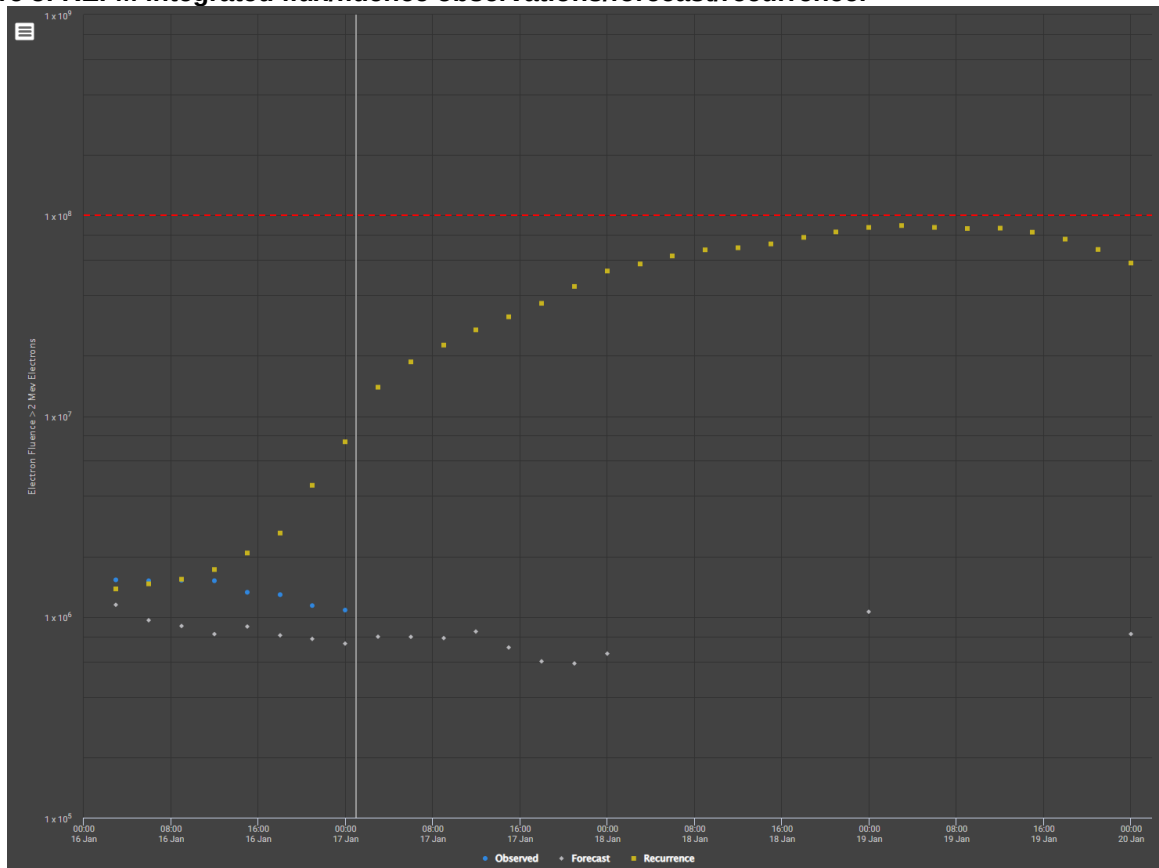
High energy electron flux (greater than 2MeV) as measured by GOES16 at GEO is currently at background to moderate levels, and in the absence of any significant enhancement is expected to persist around this level throughout much of the forecast period.

Connection to a coronal hole (CH92/+) high speed stream may occur 17 Jan, likely waning into 18 or 19 Jan, with any associated enhancement not expected to produce any significant electron response until 18 Jan at the earliest. A connection to a further coronal hole (CH93/+) high speed stream is possible from 20 Jan, perhaps briefly subduing electron counts before a possible further increase after the end of the period.

MOSWOC REFM forecast values maintains fluence well below Active throughout the period. This is considered reasonably good guidance. Recurrence values are considered to be a poor steer, as the coronal hole this time around is smaller and less pronounced and further east.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	5	10	10
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 5: REFM integrated flux/fluence observations/forecast/recurrence.



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